2012 FIFRA SECTION 18 EMERGENCY SPECIFIC EXEMPTION FOR THE USE OF HOPGUARD TO CONTROL VARROA MITE IN HONEY BEE COLONIES IN VERMONT

General information requirements of 40 CFR 166.20(a, b) in an application for a specific exemption.

TYPE OF EXEMPTION BEING REQUESTED

SPECIFIC

SECTION 166.20(a)(1): IDENTITY OF CONTACT PERSONS

(i) Contact person:
This application to the Administrator of the Environmental Protection Agency (EPA) is for a specific exemption to authorize the use of HopGuard (potassium salt of hop beta acids) to control Varroa mites in honey bee colonies. This application is submitted by the Vermont Agency of Agriculture, Food & Markets. Any questions related to this request should be addressed to:

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(ii) Qualified experts:
The following qualified expert is also available to answer questions:

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SECTION 166.20(a)(2): DESCRIPTION OF PESTICIDE

(ii) Unregistered pesticide product:

Common Chemical Name
(Active Ingredient): Potassium salt of hop beta acids (16% active ingredient (a.i.))

Trade Name: HopGuard

Registrant: BetaTec Hop Products
A Wholly Owned Subsidiary of John I. Haas, Inc.
P.O. Box 1441
Yakima, WA 98907

(A) The Confidential Statement of Formula was previously submitted to the EPA by the registrant.

(B) The proposed Section 18 label and container label are included as attachments #1 and 2.

SECTION 166.20(a)(3): DESCRIPTION OF PROPOSED USE

(i) Sites to be treated (including locations within the State):
Use of potassium salt of hop beta acids is requested for honey bee colonies located in all Vermont counties.

(ii) Method of Application:
Applications will be made by inserting cardboard strips treated with potassium salt of hop beta acids between brood frames within the honey bee colony.

(iii) Rate of application (weight of product per strip):
Strips will be applied at the rate of one strip per five deep combs covered with bees in each brood chamber or two strips per ten frame brood chambers when all the combs are covered with bees. Each strip contains approx. 1.92 grams of potassium salt of hop beta acids.

(iv) Maximum number of applications:
A maximum of six applications per year (spring, summer, and fall) or three applications for late summer and fall will be made.

(v) Total number of honey bee colonies to be treated:
The total number of honey bee colonies in Vermont that could be treated with potassium salt of hop beta acids is estimated to be approximately 10,000 bee hives registered in 2011. (Vermont Agency of Agriculture 2011).

(vi) Total amount of pesticide proposed (active ingredient and product):
Assuming that 100% of the 10,000 honey bee colonies in Vermont will be treated with four strips (two strips x two brood chambers) up to six times per year (spring, summer and fall); a maximum of 240,000 strips may be used. If 100% of the honey bee colonies in Vermont are treated, then the total amount of hop beta acids applied in Vermont will be 461 kg (240,000 strips x 1.92 grams of potassium salt of hop beta acids per strip), which is equivalent to 1,014 pounds.

(vii) Restrictions and requirements concerning the proposed use which may not appear on the labeling:

There are no restrictions or requirements for this proposed Section 18 that do not appear on the Section 18 label for HopGuard. The precautionary language, personal protective equipment, and other safety language on the container label are appropriate for the proposed Section 18.

(viii) Duration of proposed use:
The proposed use for HopGuard will be during the fall of 2012.

(ix) Earliest possible harvest dates:
Honey is typically harvested the end of July through mid-September, depending on seasonal temperatures and environmental conditions. All surplus honey will have been harvested in Vermont before the proposed application period begins.

SECTION 166.20(a)(4): ALTERNATIVE METHODS OF CONTROL

(i) Explanation why currently registered pesticides are not available and/or effective:
There are four pesticides currently approved by the EPA for control of Varroa mites and registered in Vermont, but none are providing acceptable control when used in commercial,

sideline, and hobby beekeeping operations. Varroa mites have developed resistance to one of these pesticides, rendering it virtually useless in most areas in the continental USA. The other pesticides are reported to cause bee mortality, provide inconsistent mite control and/or have use limitations that make them impractical for commercial beekeeping operations (Sammataro et al. 2010).

Apistan (fluvalinate) is one of two pesticides formulated in a contact strip that has been available to beekeepers since the late 1980s. This pesticide worked well to control Varroa mite until repeated usage for many years allowed the Varroa mite to develop resistance to the chemical. With few exceptions, Apistan no longer effective against the Varroa mite in Vermont.

ApiGuard (thymol) is a vapor-action pesticide that is formulated as a gel. It was effective in controlling Varroa mites for some years, but has lost its efficacy, according to beekeepers in some areas. The product is useful only within a certain temperature range when bees are not producing honey and, if the temperature suddenly becomes too high, bee mortality occurs if the treatment is not quickly removed (Gnazio et al. 2004).

Api Life Var (thymol/eucalyptus oil/menthol) is another vapor-action/contact pesticide that is formulated as a tablet. It is dependent on optimum temperatures when bees are not producing honey. Label requirements indicate three applications spaced 7 to 10 days apart for control, which becomes too labor intensive for the large-scale beekeeper with many outyards.

Mite-Away Quick Strips (formic acid) is a vapor-action pesticide formulated in a pre-soaked pad. This product is only useful within a certain temperature range.

(ii) Explanation why alternative practices would not provide adequate control or be economically feasible:

Apistan (fluvalinate) and Checkmite (coumaphos) are routinely detected in the wax combs in honey bee colonies, creating an additional negative impact on colony health.

ApiGuard (thymol) is too labor intensive for the commercial beekeeping operations due to its temperature dependency and bee mortality risk (Gnazio et al. 2004).

Api Life Var (thymol/eucalyptus oil/menthol) is losing favor as a suitable control product because it is reported by beekeepers to be ineffective in killing Varroa mites. In addition, bee mortality has been reported (similar to ApiGuard).

Mite Away II (formic acid) was another vapor-action pesticide that was formulated as a pre-soaked pad. The Vermont registration for this product was discontinued by the company in 2011 and replaced by Mite-Away Quick Strips. The product was hazardous to the applicator unless it was handled very carefully. Control of mites was not adequate even when temperatures fell within the recommended range. The product was ineffective if the temperature was too cold and the bees may be driven out of the hive by the vapor if the temperature was too hot (Calderone. 2009).

Mite-Away Quick Strips (formic acid) is also hazardous to the applicator unless it is handled very carefully. It is also associated with queen loss, adult bee/brood mortality and absconding when used during hot temperatures.

Sucrose octanoate esters (Sucrocide) is a contact pesticide that is formulated as a liquid, but is not registered in Vermont. It may be useful for hobby beekeepers with a few colonies; however, it is not useful for commercial beekeeping operations because of the need to remove each individual frame and spray with product, thus making the procedure too labor intensive. This product can be very harmful to bees if not applied at the correct rate (Sammatro et al. 2008).

SECTION 166.20(a)(5): EFFICACY OF PROPOSED USE

In the absence of an effective method of control for Varroa in beekeeping operations, the need arose for a new product. The identification of a naturally occurring product extracted from hops *(Humulus lupulus)* having miticidal activity prompted the company BetaTec to conduct the necessary research to determine if this new product, HopGuard could be effective in controlling Varroa mites. The results obtained from *in vivo* studies have shown that HopGuard strips are effective in killing Varroa mites and do not harm the bees. Inside the colonies, HopGuard does not disrupt colony behavior, brood production, or queen egg-laying.

Dr. Jeff Pettis of the USDA-ARS Bee Research Laboratory in Beltsville, MD, Dr. Gloria DeGrandi-Hoffinan and Fabiana Auhumada-Segura of the Carl Hayden Bee Research Center in Tucson, AZ, conducted tests with HopGuard on Varroa mite on honey bees and showed good results for efficacy in the beehive setting against the mite, with no harmful effects against the honey bee. The reports of these studies were previously submitted with the Oregon-Idaho-Washington Section 18 Request.

HopGuard was developed as a quick mite knockdown contact application. The strips are made of biodegradable material (cardboard) coated with HopGuard which is made of components that are all food grade, GRAS, and used commercially on a global scale. The strips are inserted between the frames. When the product has been delivered and is no longer on the strip, the bees chew the cardboard and remove it from the hive. The development and delivery system of HopGuard strips as a control for Varroa is compatible with commercial, sideline and hobby beekeeping operations because the strip delivery is a practice known to beekeepers, involves minimal labor, and HopGuard is a safer alternative for the bees and the beekeepers (DeGrande-Hoffman, 2010 memo, Appendix 1).

SECTION 166.20(a)(6): EXPECTED RESIDUE LEVELS IN FOOD

Hop beta acids include the closely related compounds lulupone (CAS# 468-28-0), colupulon (CAS# 468-27-9) (TOXNET 2012) and adlupone (CAS# 31769-60-5) (Chemical Book 2012) in different percentages (Betatech 2012a). These compounds differ in one side chain and are virtually inseparable by high performance liquid chromatography. Sigma Aldrich Chemical company sells the hop beta acids as “Colupulone, a mixture of homologues” with approximately 85% purity (Sigma Aldrich, 2012). EPA is recognizing the active ingredient in Hopguard as a mixture of these beta acids totaling

16%. Subtotals are not available and vary with the variety and the growing conditions of the hops (Betatech, 2012a).

The 2010 residue study was done at the USDA-ARS Carl Hayden Bee Research Facility in Tucson, AZ, using good laboratory practices. In this study hives with active honey flow were treated for 35 days with the Hopguard strips or considered controls. Mites from the hives were evaluated using sticky strips, at 48 hours; the average daily mite drop was almost 14 in the treated hives compared to two in the control hives. Hops beta acids were detected (four of the six hives, a maximum level of 9.52 ppm) in honey extracted from the bottom boxes of the hive (brood chambers where the strips were placed). Honey samples extracted from the top chambers were negative for hop beta acids (Ahumada-Segura, F., 2010a; Ahumada-Segura, F., 2010b).

During commercial treatment, Hop Guard strips will not be placed in a honey super, and it is anticipated that there will be no residues of hop beta acids in a honey super when the product used as directed (Betatech, 2012b; Betatech, 2012c).

SECTION 166.20(a)(7): RISK ASSESSMENT

HUMAN HEALTH

Hop beta acids are considered generally recognized as safe (GRAS) when used as an antimicrobial component of hotdog casings (FDA, 2001). Also hop leaves, hop vine and spent hops are used for cattle and/or sheep feed (Stanton and LeValley, 2012). The concentration of the hop beta acids in the finished feed is between 10 and 25 ppm (Betatech, 2012a). Hops and the specific hop component lupulin are on FDA's generally recognized as safe list 21 CFR § 182.20 for "Essential oils, oleoresins (solvent- free), and natural extractives (including distillates) (21 CFR 182.20; FDA, 1997)". Betatech is seeking a similar exemption for the use of hop beta acids in hives (Betatech, 2012a). Dietary risks would be negligible considering the lack of residue in honey and the proposed exemption from tolerance.

The registrant has petitioned EPA for waivers from the guideline studies regarding mammalian toxicity testing. The only toxicity testing for which EPA has specifically denied a waiver is ocular toxicity tests (40 CFR 158.2050; EPA, 2011). There is language on the proposed label requiring chemical resistant gloves and suggesting that protective eyewear be worn to protect against the irritant effects of the hop beta acids.

ENVIRONMENTAL FATE AND RISKS

Ecological and Environmental Fate Effects: Specific studies have not been conducted with HopGuard, but since the components are all food grade, GRAS, and commercially used on a global scale, there are no detrimental ecological or environmental impacts to be expected.

THREATENED AND ENDANGERED SPECIES

The proposed use of this product is intended to be applied only to the inside of the beehive and therefore expected to have no adverse effects on the threatened and endangered species or their habitats in Maine.

ENVIRONMENTAL FATE

Specific studies have not been conducted with HopGuard, but since the components are all food grade, GRAS, and commercially used on a global scale, there are no detrimental ecological or environmental impacts to be expected.

SECTION 166.20(a)(8): COORDINATION WITH OTHER AFFECTED FEDERAL, STATE, AND LOCAL AGENCIES

Other state and federal agencies will be informed, if necessary, when the exemption is approved.

SECTION 166.20(a)(9): ACKNOWLEDGEMENT BY REGISTRANT

BetaTec Hop Products, A Wholly Owned Subsidiary of John I. Haas, Inc., has been notified of this agency's intent regarding this application (letter of support from L. Schantz, attachment 3).

SECTION 166.25(b)(ii): PROGRESS TOWARDS REGISTRATION

Dr. Michael Braverman, Manager, Biopesticide and Organic Support Program, IR-4 Project, was previously contacted regarding the company's desire to obtain a Section 3 registration. IR-4 received a Project Clearance Request (PCR) Form that was submitted to IR-4 by a member of the beekeeping industry. The registering company (Beta Tec® Hop Products, A Subsidiary of John I. Has, Inc.) was subsequently assigned EPA Company Number 83623. Information is currently being gathered and presented to IR-4 for the purpose of getting the proposed pesticide classified into one of the EPA pesticide categories. The intent is for hop beta acids to be classified as a biopesticide. Additionally, the registering company has developed a draft CSF for the product and is in the process of obtaining efficacy and toxicity data in conjunction with USDA-ARS researchers. (Note -The CSF is confidential and is on file at the EPA.)

SECTION 166.20(a)(10): ENFORCEMENT PROGRAM

The Vermont Agency of Agriculture, Food & Markets (VAAFM) is the State Lead Agency for the regulation of pesticides. VAAFM will monitor the application of the exempted pesticide as needed to determine that the provisions of the specific exemption are being followed.

SECTION 166.20(a)(11): REPEAT USES

This is the first year Vermont has applied for this specific exemption for this product.

SECTION 166.20(b)(1): NAME OF PEST

Scientific and Common Name of the Pest: *Varroa destructor* (Varroa mite)

SECTION 166.20(b)(2): EVENTS OR CIRCUMSTANCES WHICH BROUGHT ABOUT THE EMERGENCY SITUATION

The ectoparasitic mite *Varroa destructor* appeared in the U.S., in 1987, and is a highly destructive pest of honey bee *Apis meliffera* colonies. The mites live in the colony, reproduce in the cells feeding on the developing larvae by sucking hemolymph and emerge from the cells to feed on the adult bees. This parasitic action vectors viral pathogens, deforms, and/or kills the young, shortens the life of the adults, and adversely affects the colony through an overall reduction in population size, vigor, and health.

Varroa is having a catastrophic effect on honey bee populations and the beekeeping industry. Colony losses across the USA this past year were approximately 21.9%, according to the annual survey conducted by the USDA. USDA-ARS researchers believe that 75% of those losses could be attributed to the direct effects of Varroa (Pettis, 2010 letter, Appendix 2). This parasitic mite is considered the number one pest of honey bees worldwide and its control is necessary for successful beekeeping (Calderone, 2009); however control options are limited.

Colony inspection performed by the apiary inspector for the VAAFM in 2011 determined Varroa mite infestations are present in over 90% of all apiaries in Vermont. The viral complex associated with Varroa infestation is strongly suspected as the primary reason for colony mortality. In recent years, the symptoms of viral pathogens that are both activated and vectored by Varroa have become more common at lower mite infestations. Therefore, the Varroa treatment threshold is now lower due to the prevalence of these viral pathogens. Northern beekeepers can no longer rely on a single Varroa treatment during fall and, at times, need to treat hives in the spring and during the short honey production period in the summer, in order to keep Varroa populations under control.

VAAFM requires all honey bee colonies to be registered, and makes *no distinction between honey producing or non-honey producing colonies.* NASS data shows only *honey producing* colonies. A review of the reporting year of 2010 indicates approximately 10,000 colonies in Vermont registered to about 1,800 beekeepers. Only a small (<2%) fraction of the registered beekeepers provide the great majority of active pollination services for commercial apple orchards, blueberries, pumpkins, and other small fruits and vegetable growers. These colonies as well as the colonies operated by hobby beekeepers also provide much needed pollination to many home and market gardens, and CSA's throughout Vermont as well as wild plants used by many species of birds and other wildlife. All beekeepers in Vermont are finding that they often must treat multiple times during the year, and that can conflict with honey production, due to the label restrictions, or application requirements of the currently approved Varroa control products. Many Vermont beekeepers have been forced to sacrifice honey production in order to treat their colonies during the honey production season. Beekeepers must decide between securing a crop of honey or saving their bees from collapse and death due to Varroa infestation.

Two EPA-registered pesticides, Apistan® (fluvalinate) and Checkmite® (coumaphos), were initially used to successfully control the Varroa mite; however, the repeated application of these products contributed to the widespread development of mite resistance to these products. Furthermore, fluvalinate and coumaphos are routinely detected in samples of wax combs used in honey bee colonies. The presence of these compounds in the combs has an additional negative impact in colony health and especially in queen rearing. With these two products no longer effective against the mites, additional products became available; however these additional products are reported to cause bee mortality, provide inconsistent mite control, and/or have use limitations that make them impractical for some beekeeping operations.

SECTION 166.20(b)(3): DISCUSSION OF ANTICPATED RISKS THAT WOULD BE REMEDIED BY THE PROPOSED USE

This emergency exemption is not expected to remedy any risks to threatened or endangered species or to the environment.

SECTION 166.20(b)(4): DISCUSSION OF ECONOMIC LOSS

Economic conditions in the beekeeping industry have become increasingly adverse since the Varroa mite was introduced into the U.S. in 1987. Control of Varroa in the colony became an added cost to beekeeping. Commercial beekeepers are suffering large colony losses due to Varroa. In the meantime, Colony Collapse Disorder (CCD) appeared and added to the economic woes of the beekeeper. The cause of CCD has not been determined, but the Varroa mite is has been implicated as a central part of the disorder. Annual colony losses in the U.S. have been greater than 30% per year in recent years (vanEngelsdorp et al., 2012). While these losses are not entirely due to Varroa, Dr. Jeff Pettis (USDA-ARS) estimates that Varroa mites could account for as much as 75% of these annual losses (Appendix 2). In Vermont, the majority of colony losses occur during late fall and winter months.

(ii) Anticipated yield in the absence of the emergency and expected losses due to the emergency:

An analysis of the 2011 USDA National Agricultural Statistic Service New England Honey Report for Vermont shows both a significant drop in honey producing colonies as well as honey production for the reporting period of 2002 – 2011. (Appendix 3, Table 1). In 2002 there were 7000 honey producing colonies reported in Vermont with a production of 623,000 pounds of honey. Over the next 9 years, there was a steady decrease in number of honey producing colonies to 4,000 reported in 2011, a reduction of about 43%. Honey production also showed a steep decline according to the statistics to 172,000 pounds, or a reduction of about 72%. Granted, this could be a statistical anomaly, but even looking at the average for the reporting years of 2002, 2003, and 2004, the average honey production was 537,000 pounds, versus the average of the most recent 3 reporting years (2011, 2010, and 2009) of 226,000 pounds, a reduction of about 58%. It is the opinion of many Vermont beekeepers as well as the apiary inspector with the VAAFM that this steady decline in both reported honey producing colony numbers and honey production is closely associated with the increasing ineffectiveness of the currently approved Varroa control products in Vermont and the steady increase in both the number and severity of Varroa infestations in Vermont honey bee colonies, which leads directly to additional stress on colonies, especially going into the late fall and winter months, when most colony mortality occurs.

(ii) Anticipated prices in absence of the emergency and changes in prices and/or production costs due to the emergency:

According to USDA-NASS 2011, the 5 prior reporting years average honey production was valued at $594,000 in Vermont (Appendix 3, Table 1). The reported valuation in 2011 was expected to have been approximately equal to this 5 year average. However, the value of production in 2011 fell to $396,000, a loss of 33.3% when compared to the previous five year average value of $594,000 (Appendix 3, Tables 1, 2).

Beekeepers have four methods to replace lost colonies:

(1) Buy full strength replacement colonies for a cost of approximately $200 each, which is the most expensive, but quickest method (if they can be found).

(2) Buy nucleus colonies for a cost of approximately $125 each. A nucleus colony is three to five frames of bees and a queen that are placed into an empty brood chamber. Over the course of a season, a nucleus colony will become a full strength colony. However, a nucleus colony will not produce any surplus honey during the first season.

(3) Split existing parent colonies for a cost of approximately $60 each. This method involves buying a queen ($25 for queen, 9 replacement frames @$3 = $27, $8 for supplemental feeding) and taking half of the brood frames from an existing parent colony and put these frames into an empty brood chamber. Over the course of a season, a split colony will become a full strength colony; however, as with a nucleus colony, it is unlikely to produce any surplus honey for harvest during the first season.

(4) Buy a package of bees for a cost of approximately $100. Three pounds of bees are purchased in a screened package with a queen. These bees are then installed into empty equipment, often hives that have died over winter, and during the course of the season, will develop into a full-size colony. As with the nucleus and split colonies, no surplus is expected from a package colony the first season.

Colony losses due to Varroa greatly influence the beekeeper's income according to the need for replacement colonies by one or all of the aforementioned methods. When many colonies are split or "nuced" in order to compensate for losses, income is lost by way of replacement cost and honey income since the nuclei hives and split hives are of lower or minimal production value. For example, the recent national survey of average winter loss over a four year period reported that colony mortality was greater than 30%. (Appendix 2) If 75% of these losses are attributed to Varroa (Appendix 2) then approximately 3,000 of the 10,000 hives in Vermont (based on VAAFM registration data) needed replacement (10,000 x 30% loss =3,000). Factor in the mortality of 75% due to varroa (3,000 x 75%) = 2,250 hives that needed replacement.

Assuming the colonies are replaced via the four methods previously stated: hive purchase ($200/colony), nuclei hives ($125/colony); splitting ($60/colony); package bees ($100) and the cost of replacement (due to Varroa loss) is approximately $272,812. This annual replacement cost is almost 60% of the 5 Year Average Value of Production (Table 1). This cost does not include the increased labor costs associated with establishing new colonies or the loss of production from these new colonies.

Based on our analysis of the above information, the VAAFM strongly believes that an emergency condition exists in Vermont. Honey bee colonies are critical to the production of numerous fruit and vegetable crops grown in Vermont. Failure to have an effective pesticide to control Varroa mites would be disastrous to beekeepers and to the crops that depend on honey bees for pollination, both cultivated and native.

REFERENCES

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APPENDIX 1

USDA

United States Department of Agriculture

Research, Education and Economics
Agricultural Research Service

July 22, 2010

To: Gene Probasco

From Dr. Gloria DeGrandi-Hoffman Ph.D.
Research Leader

Re: Section 18 for HopGuard

This memo is to provide information on the comparative ease of use for HopGuard relative to other products available for control of Varroa mites in honey bee colonies. Certainly, any product that is delivered in a strip that is placed in the colony will take less time to apply and be less disturbing to the colony than products that are applied on or between all brood frames or that the beekeeper needs to place on paper for dispensing. Commercial beekeepers make applications of Varroa treatments to thousands of colonies, and those products that can be applied in a few seconds per colony are the most desirable.

ars

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Agricultural Research - Investing in Your Future

APPENDIX 2

USDA

United States Department of Agriculture

Research, Education, and Economics
Agricultural Research Service

June 13, 2010

Mr. Lloyd Schantz
Vice President
J. I. Haas, Inc.

Dear Lloyd,

I write in support of Hopguard® as a varroa mite control product and your company's efforts to get it to beekeepers under a section 18 exception. The parasitic varroa mite is considered the number one pest of bees worldwide and its control is necessary for successful beekeeping. Our control options are limited. Further the mite has developed resistance to the two synthetic products used in the U.S., fluvalinate and coumaphos. Thus a real need exist for alternatives.

As you know the beekeeping industry has been suffering extensive losses over the past few years. Our four years of survey of U.S. beekeepers has indicated a greater than 30% loss of bee colonies over the fall and winter; a rate of loss that puts many beekeepers at risk of economic collapse. Colony Collapse Disorder (CCD) has been one of the leading causes of these recent losses but is by no means the only reason. Additionally, we suspect that varroa mites are a likely primary stress factor on bees that allows for pathogens like virus to take hold. I expect that Varroa mites could account for as much as 75% of the bee losses in any particular year. The collapse of colonies that we call CCD could be initiated by the stress caused by the feeding of Varroa. CCD remains unresolved but if we had better varroa control products it is certain that bee health would improve.

The beekeeping industry is in real and immediate need of varroa control alternatives. My experience to date with Hopguard® has been positive and I feel this product will offer a safe and effective alternative to the hard chemicals we have been relying upon but which the mites have developed resistance to. Please let me know if you need additional information or if I can be of further assistance.

Sincerely,

Jeff Pettis

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APPENDIX 3

Table 1. Vermont honey production and value 2002-2011.

	Honey Producing Colonies	Yield per Colony (lbs.)	Production (lbs.)	Ave. Price per Pound (dollars)	Value of Production (dollars)
2002	7000	89	623,000	1.20	748,000
2003	7000	83	581,000	1.96	1,139,000
2004	6000	68	408,000	1.51	616,000
2005	6000	91	546,000	1.12	612,000
2006	6000	56	336,000	1.20	403,000
2007	5000	64	320,000	1.70	544,000
2008	5000	66	330,000	2.20	726,000
2009	5000	49	245,000	2.01	492,000
2010	4000	65	260,000	3.10	806,000
5 Year Ave.	5,400	60	298,200	2.04	594,200
2011	4000	43	172,000	2.30	396,000

Source: USDA-NASS 2011

Table 2. Analysis of Honey Production and The Beekeeping Industry In Vermont

	Baseline	Emergency	Change	% Change
	Prior 5 years Average	2011		
Honey production (lbs.)	298,200	172,000	-126,200	-42.3
Honey income	$594,200	$396,000	-$198,200	-33.3
Gross revenue	**$594,200**	**$396,000**	**-$198,200**	**-33.3**
Replacement colony cost ($200/colony)		$112,500	-$112,500	
Nucleus colony cost ($125/colony)		$70,312	-$70,312	
Split existing parent colony cost ($60/colony)		$33,750	-$33,750	
Buy Package Bees ($100)		**$56,250**	**-$56,250**	
Total additional costs		**$272,812**	**-$272,812**	**-45.9**
Total losses (% change compared with gross revenue)			**-$471,012**	**-79.2**